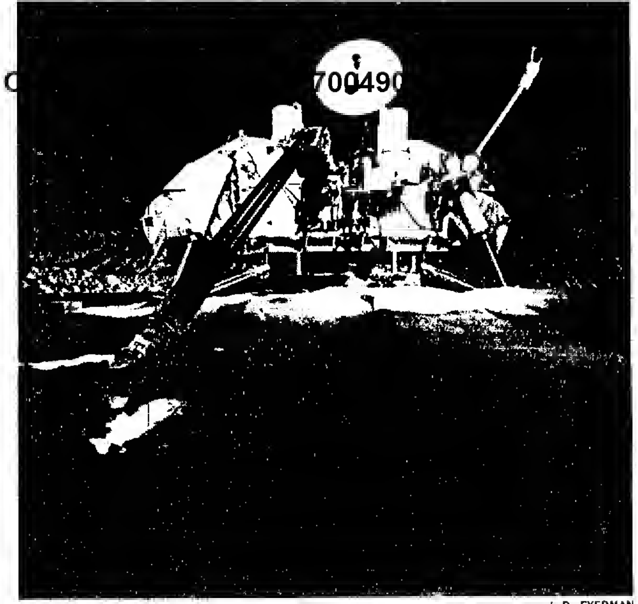

J. R. EYERMAN

Practicing a dig, a Viking lander at the Jet Propulsion Laboratory (**above**) extends its surface sampler over simulated Martian rocks—Styrofoam—to scoop simulated Martian soil—earth sand.

In this manner, technicians rehearsed operations on earth before Viking performed them on Mars.

In addition to the biology instrument and two cameras, the jeep-size lander carries other devices (**below**) to sample weather, analyze soil and atmosphere, and record any seismic tremors.

Data from the tests are stored on magnetic tape, then transmitted to the orbiter for relay to earth.

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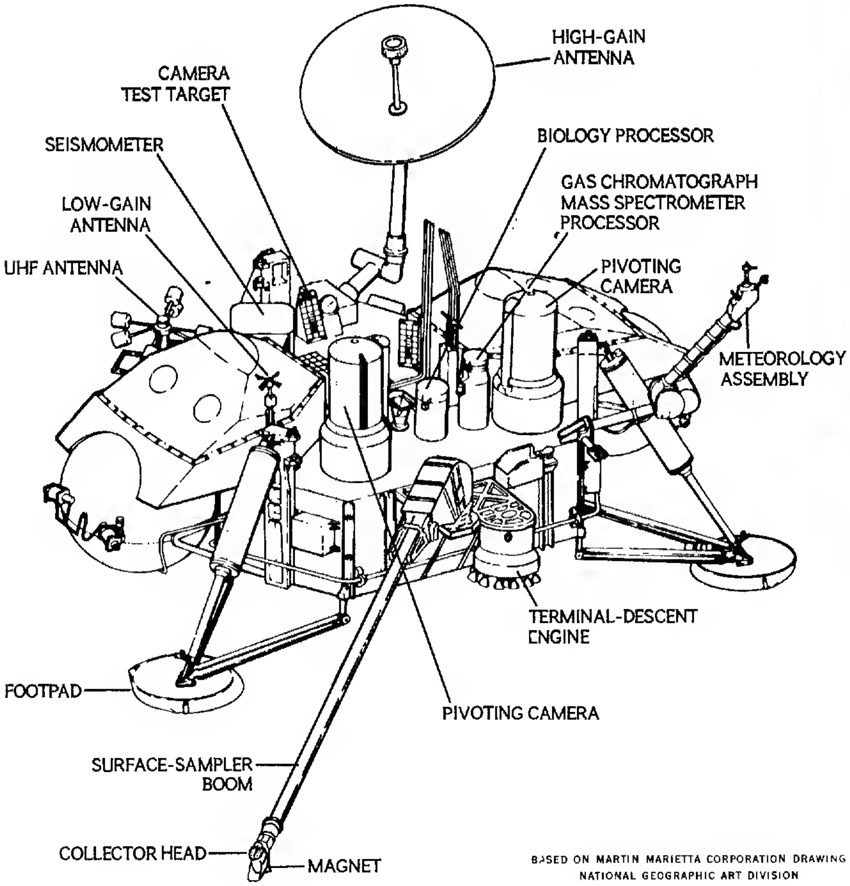
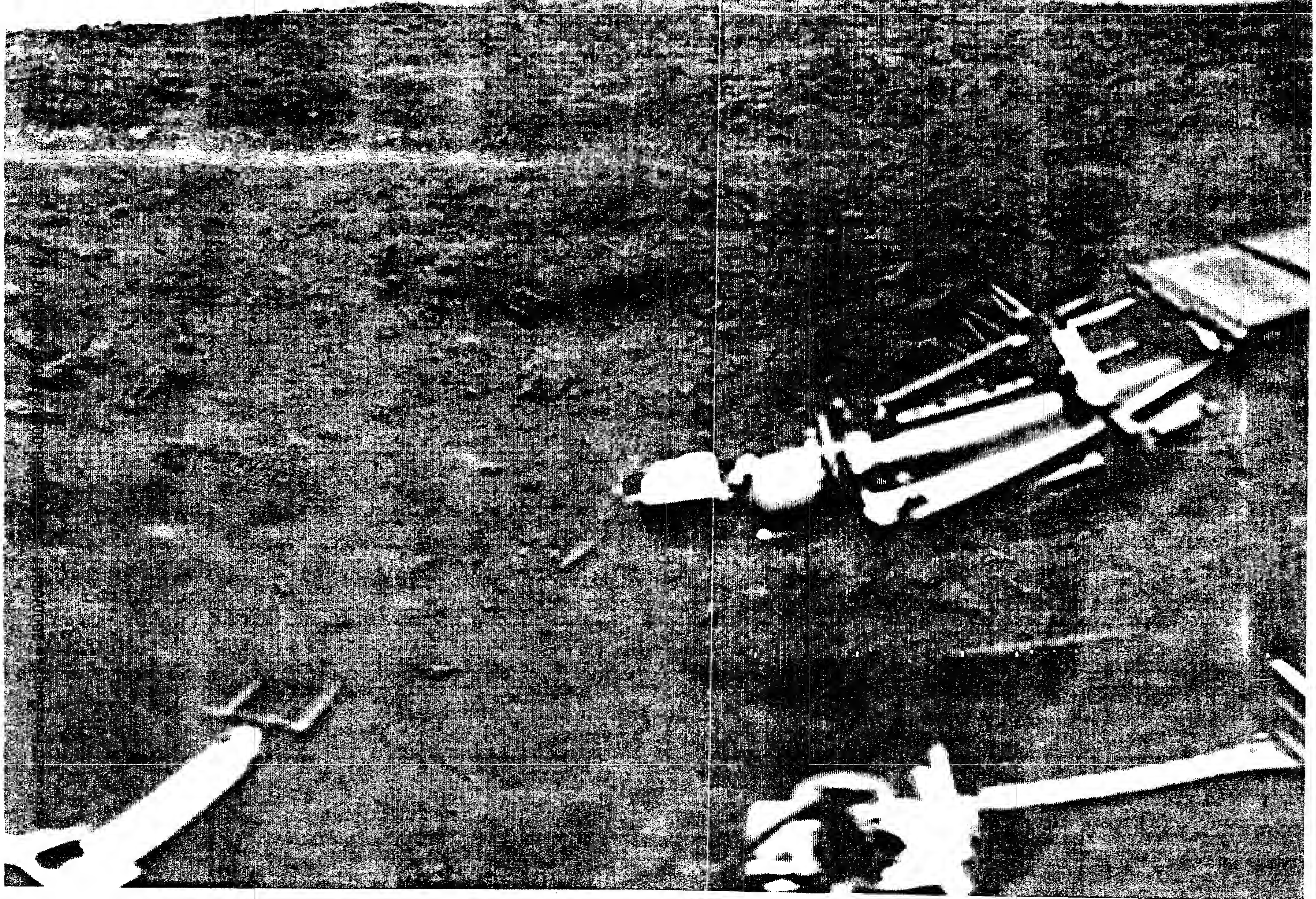
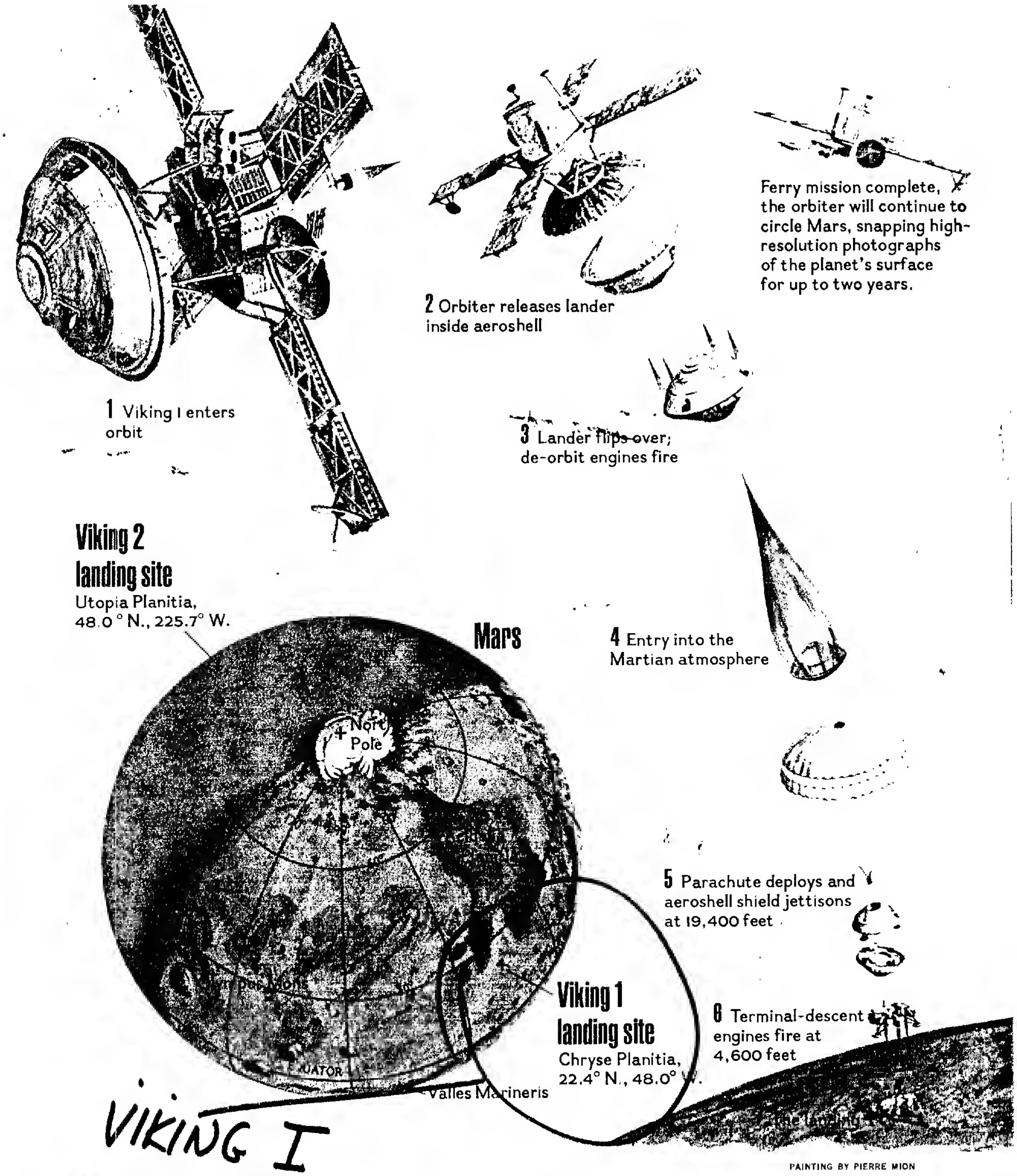


BASED ON MARTIN MARIETTA CORPORATION DRAWING
NATIONAL GEOGRAPHIC ART DIVISION



After trenching the face of Mars, far left, the Viking 1 lander's soil sampler quietly awaits further instructions. But the dirt it dug went on an amazing chemical rampage inside the lander's biology instrument. Scientists were cautious about interpreting early results as evidence of life. Perhaps, they theorized, the nutrients or water used in the tests triggered oxidizing compounds that do not occur naturally on earth but may be present in Martian soil.



PAINTING BY PIERRE MION

"We have touchdown!"

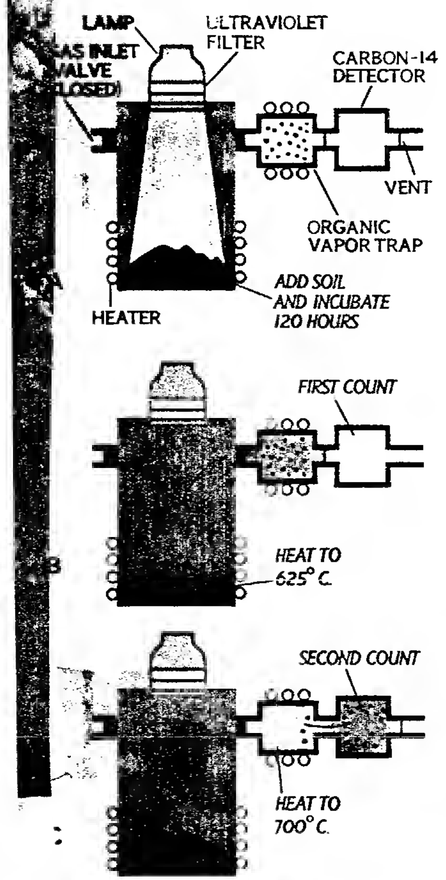
TO ENTER ORBIT, Viking 1 fires its braking engine (1). Landing-site safety check complete, the orbiter releases the lander, cocooned in a saucerlike, protective aeroshell (2). Since it takes as long as 22 minutes for a radio signal to reach Mars from earth, a computer in the lander masterminds the landing sequence.

First, it ignites the de-orbit engines that nudge the aeroshell out of orbit and into a landing trajectory (3). As the aeroshell plunges into the Martian atmosphere, frictional temperatures up to 1,500° Celsius (2,730° F.) sear the ablative shield (4). When the aeroshell has slowed to less than 600 miles an hour, the computer deploys a parachute for further braking and jettisons the protective shield (5). Later, the parachute is released.

Terminal-descent engines (6) slow the lander to five mph and triumphant touchdown (7).

DIAGRAMS BY PIERRE MION AND ELIE SABBAN

"I almost expected to see camels," said a Viking scientist of the windswept, rock-strewn landscape at Chryse Planitia, remarkably similar to deserts on earth. Geologists cataloged an unexpected variety of rocks, from basalts to breccias, from pebbles to a ten-foot-long boulder, left. Though Viking 1 landed during Martian summer, weather instruments atop the meteorology boom, center, recorded frigid temperatures: a low of −86° C. (−123° F.) just after sunrise, a high of −31° C. (−24° F.) in midafternoon. Winds were light.

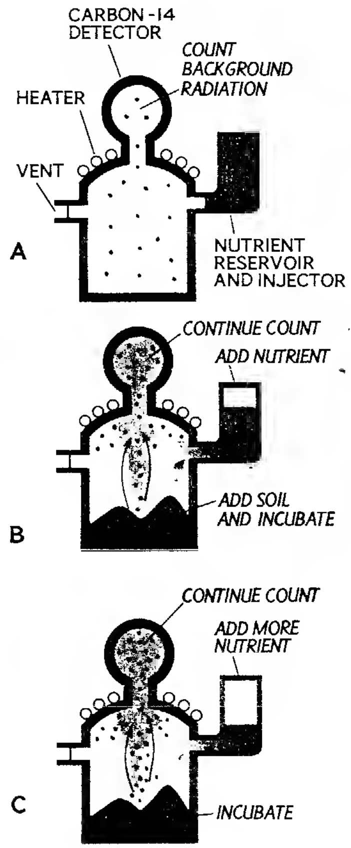


Is food manufactured?

The pyrolytic release (PR) experiment looks for microorganisms which, like plants photosynthesizing on earth, turn carbon gases in the air into carbon-based, organic molecules.

Soil is placed in a thumb-size chamber (A). Carbon dioxide and carbon monoxide are added, made of traceable radioactive carbon 14. The soil incubates beneath a lamp that simulates Martian sunlight, minus its ultraviolet rays. Any microorganisms should take up the radioactive gases. The chamber is heated (B) to pyrolyze, or decompose, any microbes present into organic gases.

These gases are forced into the organic vapor trap, which lets other gases pass through to a radiation detector for a first count. Higher heating (C) then releases organic vapors so that they, too, escape. If these vapors prove radioactive, they probably come from living organisms.



Is food consumed?

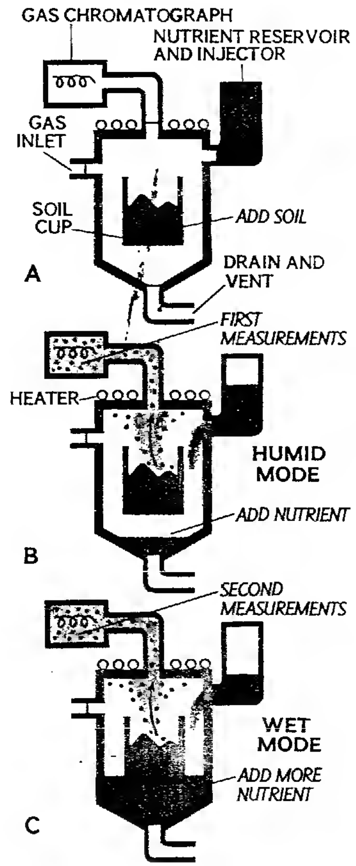
Living organisms must eat to sustain life. As they convert food into energy and tissue, they release gases, including carbon dioxide.

In the labeled release (LR) experiment, radioactive nutrient is added to a soil sample in the hope that something will digest it and give off radioactive carbon dioxide.

A count is made (A) to determine any background radiation prior to the test.

Martian atmosphere and soil are added to the chamber, and the latter is sprayed with tiny drops of nutrient (B). As with the gases in the PR experiment, these carbon compounds contain radioactive carbon 14.

As the soil incubates, a detector looks for a rise in radioactivity, indicating Martian organisms are metabolizing. After a week or two the soil is squirted with a second course of nutrient (C). The detector continues its watch.



Is the air altered?

Just by living, a creature affects its environment. People take in oxygen and give off carbon dioxide. It's the same with microbes. As they metabolize, they consume and produce gases that can be measured.

The gas exchange (GEX) experiment looks for changes that Martian microbes might cause in gas levels over a long period.

Soil is placed in a test chamber (A), sealed to prevent gas leakage. A nutrient is added in two phases.

In the "humid mode," just enough nutrient flows to the bottom of the chamber to humidify the soil (B). If the soil contains dormant spores or seeds, the water vapor might awaken them. A gas chromatograph measures the gases. Certain rises or falls would indicate biological processes.

In the "wet mode," nutrient saturates the soil (C). Measurements last for several months.

For early results of these three tests, see pages 23-26.